WHAT IS CLAIMED IS:

1. A method of estimating a steering angle offset value in a vehicle having a relative position steering angle sensor, said method comprising:

providing a mathematical expression for calculating an estimated steering angle offset value, $\hat{\delta}_{off}$, based upon at least one measured value of a vehicle operating parameter wherein said mathematical expression is definable by:

selecting a mathematical model to describe the dynamic behavior of the vehicle which includes a first variable, δ, representing the steering angle of the vehicle; and

substituting, for said first variable, δ, the sum of a second variable, $\delta_{Uncenter}$, representing the relative steering angle position and a third variable, δ_{off}, representing the steering angle offset in said model to provide said mathematical expression;

obtaining said at least one measured value for said vehicle; and

estimating said steering angle offset value using said at least one measured value and said mathematical expression.

2. The method of claim 1 wherein said third variable is a state variable with respect to said mathematical expression.

3. The method of claim 1 wherein said at least one measured value includes the yaw rate of the vehicle.

4. The method of claim 1 wherein said at least one measured value includes the yaw rate of the vehicle and the relative steering angle position.

5. The method of claim 1 wherein said at least one measured value includes the yaw rate of the vehicle, the relative steering angle position and the longitudinal velocity of the vehicle.

6. The method of claim 1 further comprising the estimation of the body slip angle of the vehicle using said at least one measured value and said mathematical expression.

7. The method of claim 1 wherein said model comprises:

$$\begin{bmatrix} \dot{\beta} \\ \ddot{\psi} \end{bmatrix} = \begin{bmatrix} -\frac{C_v + C_h}{mv} & \frac{C_h l_h - C_v l_v}{mv^2} - 1 \\ \frac{C_h l_h - C_v l_v}{J_z} & -\frac{C_v l_v^2 + C_h l_h^2}{J_z v} \end{bmatrix} \begin{bmatrix} \beta \\ \dot{\psi} \end{bmatrix} + \begin{bmatrix} \frac{C_v}{mvi_s} \\ \frac{C_v l_v}{J_z i_s} \end{bmatrix} \cdot \delta$$

wherein:

β represents the body slip angle;

$\dot{\psi}$ represents the yaw rate;

δ represents the steering angle;

m represents the mass of the vehicle;

v represents the longitudinal speed of the vehicle;

J_z represents the inertia moment of the vehicle around its mass center point;

i_s represents the steering angle ratio;

C_v represents the cornering stiffness value of front tires;

C_h represents the cornering stiffness value of the rear tires;

l_v represents the distance from the front axle to the mass center point of the vehicle; and

l_h represents the distance from the rear axle to the mass center point of the vehicle.

8. The method of claim 7 wherein said step of substituting the sum of said second and third variables in said model provides a mathematical expression which states:

$$\begin{bmatrix} \dot{\beta} \\ \ddot{\psi} \\ \dot{\delta}_{Off} \end{bmatrix} = \begin{bmatrix} \frac{C_v + C_h}{mv} & \frac{C_h l_h - C_v l_v}{mv^2} - 1 & \frac{C_v}{mvi_s} \\ \frac{C_h l_h - C_v l_v}{J_z} & -\frac{C_v l_v^2 + C_h l_h^2}{J_z v} & \frac{C_v l_v}{J_z i_s} \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \beta \\ \dot{\psi} \\ \delta_{Off} \end{bmatrix} + \begin{bmatrix} \frac{C_v}{mvi_s} \\ \frac{C_v l_v}{J_z i_s} \\ 0 \end{bmatrix} \cdot \delta_{Uncenter} .$$

9. The method of claim 8 wherein said step of substituting the sum of said second and third variables further comprises reformulating said model after substituting said sum, said step of reformulating said model provides a mathematical expression which comprises:

$$x(k+1) = A(k)x(k) + b(k) \cdot u(k) + v(k)$$

$$y(k) = c^T x(k) + w(k)$$

wherein:

k represents a time index,

$$A = \begin{bmatrix} a_{11} & a_{12} & b_1 \\ a_{21} & a_{22} & b_2 \\ 0 & 0 & 0 \end{bmatrix},$$

$$x^T = [\beta \quad \dot{\psi} \quad \delta_{Off}],$$

$$b = \begin{bmatrix} b_1 \\ b_2 \\ 0 \end{bmatrix},$$

$$u = \delta_{Uncenter},$$

v(k) represents the process noise,

w(k) represents the measurement noise, and

$$c^T = [0 \quad 1 \quad 0].$$

10. The method of claim 1 wherein said step of estimating said steering angle offset value includes use of the mathematical expression which comprises:

$$\hat{\mathrm{x}}(k+1) = \mathbf{A}(k)\,\hat{\mathrm{x}}(k) + \mathrm{b}(k) \cdot u(k) + \mathbf{K}(k)(\mathrm{y} - \hat{\mathrm{y}})$$

$$\hat{\mathrm{y}}(k) = \mathrm{c}^T\ \hat{\mathrm{x}}(k)$$

wherein

$$\hat{\mathrm{x}}(k) = [\hat{\beta} \quad \hat{\dot{\psi}} \quad \hat{\delta}_{\mathrm{Off}}]^T;$$

$\hat{\beta}$ represents the estimated value of the body slip angle;

$\hat{\dot{\psi}}$ represents the estimated value of the yaw rate;

$\hat{\delta}_{off}$ represents the estimated value of the steering angle offset;

$K(k)$ represents a gain matrix.

11. The method of claim 1 further comprising the steps of:
estimating a plurality of steering angle offset values; and

filtering said plurality of estimated steering angle offset values.

12. The method of claim 10 wherein said filtering step comprises using a variable filter coefficient, F_k.

13. The method of claim 11 wherein said variable filter coefficient is calculated using an uncertainty factor, U_k, said uncertainty factor, U_k, being determined using at least one value from the group including the yaw rate of the vehicle, the estimated steering angle position and the lateral acceleration of the vehicle.

14. The method of claim 12 wherein said uncertainty factor, U_k, is determined using the following equation:

$$U_k = c_\psi\left(\dot{\psi} \cdot \int \dot{\psi} dt\right) + c_\delta \cdot \left|\delta_{uncenter} + \hat{\delta}_{off}\right| + c_y\left|a_y - \hat{a}_y\right|,$$

wherein:

$\delta_{Uncenter}$	represents the uncorrected relative steering angle position;
$\hat{\delta}_{off}$	represents the estimated steering angle offset;
$\delta_{Uncenter} + \hat{\delta}_{off}$	represents the estimated steering angle position;
$\dot{\psi}$	represents the yaw rate of the vehicle;
a_y	represents the lateral acceleration of the vehicle; and
c_P, c_δ, and c_y	represent constants.

15. A method of controlling a vehicle, said method comprising:
providing a mathematical expression for estimating first and second vehicle operating parameters wherein said mathematical expression is definable by:

selecting a mathematical model to describe the dynamic behavior of the vehicle;

reformulating said model to provide said mathematical expression wherein said mathematical expression includes a model difference term dependent upon a difference between an estimated value of said second vehicle operating parameter and a measured value of said second vehicle operating parameter;

obtaining a signal representing a measured value of said second vehicle operating parameter;

estimating said first vehicle operating parameter using said mathematical expression wherein calculation of an estimated value for said first parameter includes using said measured value represented by said signal in said model difference term; and

outputting said estimated value for use in an electronic control system for said vehicle.

16. The method of claim 15 wherein said first and second parameters are selected from the group including the steering angle offset, the yaw rate and the body slip angle of the vehicle.

17. The method of claim 15 wherein said first parameter is the steering angle offset and said second parameter is the yaw rate of the vehicle.

18. The method of claim 17 wherein said mathematical expression comprises:

$$\hat{x}(k+1) = \mathbf{A}(k)\,\hat{x}(k) + b(k)\cdot u(k) + \mathbf{K}(k)(y - \hat{y})$$

$$\hat{y}(k) = c^T\,\hat{x}(k)$$

wherein

k represents a time index,

$$A = \begin{bmatrix} a_{11} & a_{12} & b_1 \\ a_{21} & a_{22} & b_2 \\ 0 & 0 & 0 \end{bmatrix},$$

$$b = \begin{bmatrix} b_1 \\ b_2 \\ 0 \end{bmatrix},$$

$$u = \delta_{Uncenter},$$

$$\hat{x}(k) = [\hat{\beta} \quad \hat{\dot{\psi}} \quad \hat{\delta}_{\mathrm{Off}}]^T;$$

$\hat{\beta}$	represents the estimated value of the body slip angle;
$\hat{\dot{\psi}}$	represents the estimated value of the yaw rate;
$\hat{\delta}_{off}$	represents the estimated value of the steering angle offset;
$K(k)$	represents a gain matrix;
$(y-\hat{y})$	represents said model difference term;
c^T	represents an output vector.

19. A method of filtering a plurality of time indexed values in a process for determining a steering angle position of a vehicle having a relative position steering angle sensor, said method comprising:

estimating a plurality of time indexed steering angle offset values;

filtering a plurality of time indexed values which are a function of said plurality of time indexed steering angle offset values using a variable filter coefficient, F_k, said variable filter coefficient, F_k, being determined using an uncertainty factor, U_k, said uncertainty factor, U_k, being determined using at least one value from the group including the yaw rate of the vehicle, the estimated steering angle position and the lateral acceleration of the vehicle.

20. The method of claim 19 wherein said plurality of time indexed values is identical to said plurality of time indexed steering angle offset values.

21. The method of claim 19 wherein said uncertainty factor, U_k, is determined using the following equation:

$$U_k = c_\psi\left(\dot{\psi} \cdot \int \dot{\psi} dt\right) + c_\delta \cdot \left|\delta_{uncenter} + \hat{\delta}_{off}\right| + c_y\left|a_y - \hat{a}_y\right|,$$

wherein:

$\delta_{Uncenter}$	represents the uncorrected relative steering angle position;
$\hat{\delta}_{off}$	represents the estimated steering angle offset;
$\delta_{Uncenter} + \hat{\delta}_{off}$	represents the estimated steering angle position;
$\dot{\psi}$	represents the yaw rate of the vehicle;
a_y	represents the lateral acceleration of the vehicle; and
c_P, c_δ, and c_y	represent constants.

22. The method of claim 21 wherein said filtering step comprises the use of the formula:

$$\delta_{Off,k+1} = \delta_{Off,k} + F_k \cdot \left(\hat{\delta}_{Off} - \delta_{Off,k}\right)$$

wherein:

k represents the time index; and

the filter coefficient, F_k, is defined as:

$$F_k = T(1 - Q_k)$$

wherein:

$$Q_{k+1} = Q_k + T \cdot (1 - Q_k)$$

and T is defined as:

$$T = c_0(1 - U_k Q_k)$$

wherein:

c_o represents a constant.